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Social Science & Medicine 58 (2004) 1147–1158

SOCIAL SCIENCE & MEDICINE

www.elsevier.com/locate/socscimed

The generational transmission of socioeconomic inequalities in child cognitive development and emotional health

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Abstract

Socioeconomic inequalities in the health of adults have been largely attributed to lifestyle inequalities. The cognitive development (CD) and emotional health (EH) of the child provides a basis for many of the health-related behaviours which are observed in adulthood. There has been relatively little attention paid to the way CD and EH are transmitted in the foetal and childhood periods, even though these provide a foundation for subsequent socioeconomic inequalities in adult health.

The Mater-University of Queensland Study of Pregnancy (MUSP) is a large, prospective, pre-birth cohort study which enrolled 8556 pregnant women at their first clinic visit over the period 1981–1983. These mothers (and their children) have been followed up at intervals until 14 years after the birth.

The socioeconomic status of the child was measured using maternal age, family income, and marital status and the grandfathers' occupational status. Measures of child CD and child EH were obtained at 5 and 14 years of age. Child smoking at 14 years of age was also determined.

Family income was related to all measures of child CD and EH and smoking, independently of all other indicators of the socioeconomic status of the child. In addition, the grandfathers' occupational status was independently related to child CD (at 5 and 14 years of age). Children from socioeconomically disadvantaged families (previous generations' socioeconomic status as well as current socioeconomic status) begin their lives with a poorer platform of health and a reduced capacity to benefit from the economic and social advances experienced by the rest of society.

Keywords: Grandfather; Socioeconomic; Longitudinal; Child; Cognitive; Mental health

Introduction

Traditional risk factors measured at an adult baseline (smoking, cholesterol, blood pressure, etc.) predict about one-third of the socioeconomic gradient in subsequent mortality (van Rossum, Shipley, van de Mheen, Grobbee, & Marmot, 2000; Lantz et al., 2001). The identification of a risk behaviour at a point in time may well underestimate the importance of this risk factor, largely because the length of time an individual has been exposed to risk may not have been considered. Is a design which focuses upon the cumulative health effects of exposure to risk likely to change the way we understand the contribution of socioeconomic inequalities to health care outcomes? In particular there has been little attention paid to the development of a child's cognitive abilities and emotional competence as these might contribute to socioeconomic inequalities in health outcome. General intelligence and emotional competence are likely to contribute to socioeconomic inequalities in health outcome in a variety of important health

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0277-9536/03/$ - see front matter
doi:10.1016/S0277-9536(03)00286-7

domains. This is not to deny that the likely causal sequence may be complex and varied. For example, data from the 1932 Scottish Mental Health Survey Cohort indicates an association between parental social class and child intelligence at 11 years of age (Shenkin et al., 2001) and child intelligence at 11 years of age and inequalities in health in later life (Starr, Deary, Lemmon, & Whalley, 2000). These associations will be mediated by such influences as lifestyle decisions (e.g. tobacco use, diet), employment outcomes and by environmental factors.

To what extent are general intelligence and emotional competence a consequence of socioeconomic inequalities that are experienced by the child at various points in his/her life course? This paper examines the association between maternal socioeconomic status (SES) and indicators of the child's cognitive development and emotional health at 5 and 14 years of age. It aims to distinguish the generational transmission of health inequalities (grandparents' SES) from the impact of the concurrent SES of the child as assessed by family income.

The importance of early cognitive development

Over the last decade, there has been growing support for the view that there is a "critical" period for brain development from birth through the early years of childhood (Wynder, 1998). Both genetics and environment are likely to be important determinants of brain development (Kotulak, 1998). Tirozzi (1998, p. 248) explains the relationship between these two influences by describing genes as "the bricks and mortar that build a child's brain", and a child's environment as "the master architect". The quality of the child's early life environment plays an important role in determining the level of brain stimulation and thus brain development. Brain development is fundamental to the child's school performance and achievement, and most likely sets the limits within which his/her future economic, social, educational and health outcomes are likely to occur. A child's cognitive development is likely to be central to an individual's academic and economic progress as an adult. Cognitive ability and development are perceived to be central to an individual's capacity to learn, and to adapt to and exploit the opportunities available within his/her environment.

Evidence that childhood mental health has effects on health in adulthood is limited, in large part because relevant data is scarce. One review argues that it is well known that well-adjusted, stable and integrated individuals have lower rates of disease (Friedman, 2000). Pine, Cohen, Brook, and Coplan (1997) longitudinally examined the relationship between psychopathology and obesity in young adulthood. Given that some forms of mental illness have a biological/genetic basis, it is not surprising to find that childhood psychiatric disorder predicts adult psychopathology (Amminger et al., 2000). Emotional control and cognitive and social capacity are significantly associated with reduced risk of adult drug use (Stenbacka, 2000). Cardiovascular patients with higher intelligence and greater cognitive flexibility have a better prognosis than patients with a lower cognitive ability (Myers, 1998).

SES and cognitive development

Child verbal ability and educational outcomes are positively related to SES variables (Alwin & Thornton, 1984). Duncan, Yeung, Brooks-Gunn, and Smith (1998) identified family income in early childhood as having a larger impact on completed schooling than in middle childhood. The quality of the home environment during preschool years has also been found to have a greater impact on children's mathematics and reading scores, than the home environment at the time mathematics and reading ability were measured (Baharudin & Luster, 1998). Maternal income has been found to influence the cognitive abilities of children independently of maternal educational status, with the home environment being found to be a mediating factor (Smith, Brooks-Gunn, & Klebanov, 1997).

The highly intercorrelated nature of many of the variables involved makes the determination of causal and mediating variables particularly problematic. Children born to generally lower SES and teenage mothers appear to be at increased risk for impaired of lower IQ scores (Kenny, 1995) and poorer linguistic outcomes (Spieker & Bensley, 1994). Data from the 1958 British Birth Cohort Study (Jefferis, Power, & Hertzman, 2002) indicates that class inequalities in cognitive ability increase over the life course. Turley (1999) suggests that maternal age at first birth is significantly associated with cognitive test scores of firstborn children as well as those from subsequent births, however conflicting evidence has been provided by Geronimus, Korenman, and Hillemeier (1994). Other research has shown no direct association between teenage maternity and IQ, but has pointed to a possible indirect effect of parental education on offspring intelligence (Cohen, Belmont, Dryfoos, Stein, & Zayac, 1980).

SES and child mental health/behaviour

There is an emerging body of research suggesting that parental socioeconomic disadvantage is associated with child mental health. Poverty has been associated with youth delinquency (Pagani, Boulerice, Vitaro, & Tremblay, 1999), and with externalising, internalising and attentional problems in children at age 5 (Bor et al., 1997). Similar findings have been noted for an older child cohort (Zubrick et al., 1995).

Younger and/or single mothers are disproportionately represented in the lowest income groups. Both of these groups may have higher rates of marital conflict and parenting practices which may lead to increased levels of child mental health impairment (Najman et al., 1994). Children of adolescent mothers have been found to be at higher risk of flattened affect and aggressive behaviour (Zahn-Waxler, Kochanska, Krupnik, & McKnew, 1990). Dixon, Charles, and Craddock (1998) found that there was an increase in externalising behaviour for children whose parents divorced, although the mediating factor here appeared to be parental conflict. Najman et al. (1997) found that women who had more than one partner were found to have children with a higher rate of mental health/behaviour problems.

Continuity of child cognitive development and mental health

Child IQ shows a high level of continuity into adulthood. Mental health problems in children also have a high level of continuity into adulthood. Continuity of IQ and mental health over the life course is not surprising given that both dimensions of development have a biological and environmental basis.

Child behaviour problems are of concern because on the one hand they reflect impaired child mental health and, on the other, they have been linked to health outcomes such as obesity in adulthood (Pine et al., 1997), substance use in adolescence regardless of gender (Disney, Elkins, McGue, & Iacono, 1999) and, as well, juvenile delinquency and criminality (Nagin & Tremblay, 1999; Herrenkohl et al., 2000). Children with persistent problems from ages 3–9 are more likely to meet diagnostic criteria for externalising diagnosis at age 13 than are children whose problems were less stable in elementary school (Pierce, Ewing, & Campbell, 1999). Kumpulainen, Rasanen, Henttonen, Hamalainen, and Roine (2000) found that those children having problems requiring special attention in infancy according to hospital birth records, and who exhibited emotional/behavioural problems before school age have been found to be at increased risk for psychiatric disturbance at both 8 and 15 years of age. Mother reports of child temperament difficulties at 4 months of age have been found to predict behaviour problems six years later (Wasserman, DiBlasio, Bond, Young, & Colletti, 1990).

Many of the "risk" health behaviours observed in adults have their origins in childhood. For example, almost all adult smokers commence this habit before the age of 20 and, because it is adopted early, is likely to involve a period of greater exposure to adverse outcomes. Lower education level has been found to be a strong predictor of both smoking prevalence and intensity of smoking (Setter, Peter, Siegrist, & Hort, 1998).

SES of a foetus/young child

Children are necessarily ascribed the SES of their parents. Since the 1970s, there have been significant demographic changes characterised by increases in divorce, separation, remarriage and single parenthood. Some of these changes may potentially disadvantage the child in ways that encompass more than might be captured by traditional SES measures such as income, occupation, and education. Benzeval (1998) has observed that single mother status may be an important reflection of a families socioeconomic circumstances. Such families are sometimes excluded from research because the biological father is not present and the mother is not in the workforce. Socioeconomic studies of health which exclude single mothers may significantly misrepresent reality. Further, divorce, separation, and single parenthood may impact negatively on the developing child in a number of ways. These include: the decreased wellbeing of the custodial parent, following a substantial increase in domestic and financial responsibilities; increases in spousal conflict; economic strain; changes of residence; and, the entrance (and/or departure) of one or more adults into the child's life as a consequence of the development of new intimate relationships for the parents. Whatever indicators of social class/SES are selected, it is important that these not exclude non-employed women caring for children.

Methodology

Sample

Data were derived from the Mater-University Study of Pregnancy (MUSP) and its outcomes. This is a prospective longitudinal pre-birth cohort of mothers and their children.

Some 8556 consecutive women attending their first obstetrical visit were invited to participate in the study. There were 98 subjects who rejected the request to participate in the study. Some 171 mothers miscarried, there were 388 transfers to other hospitals (not included in this study), some 59 twins (excluded from this analysis), 59 deaths during delivery, 55 deaths post-delivery. A further 143 mothers were unable to be located—possibly because they moved to another location without informing the hospital. A sample of 7661 mothers and children remained after limiting the analysis to live, singleton births at the study hospital.

Follow-ups of mothers and their children were conducted at 3–5 days, 6 months, 5 and 14 years after the birth of the child. About 70% of those mothers who gave birth to a live singleton baby at the study hospital (the entry criteria) remained in the study at the 5-year and 14-year follow-ups, with some 60% being available

at both follow-ups. The present paper is limited to the cohort who participated in both the 5- and 14-year phases and who provided useable responses to the questions of interest. This leaves about 4600 of 7661 (60%) mothers and their children in the current follow-up. Not all respondents provided data for all questions, thus the frequencies vary somewhat from table to table.

Measures

Socioeconomic status

Demographic information collected at the first clinic visit was used for the purposes of this investigation. At entry to the study, respondents were asked to describe their father's occupation, which was coded according to their occupational status, i.e. prestige (Najman & Bampton, 1991). The maternal grandfather's occupation was coded into the following categories; lower social class, middle to lower class, and high to middle class. The sample derives from a public hospital and is skewed towards lower class groups. Few upper class pregnant women in Australia use the public (free) health system for their obstetrical care. The maternal grandfather's occupation had been included in the analysis to provide an indicator of the contribution of inherited human and learnt social capital transmitted from the earlier generation via the mother to the child, in addition to the mother's age, marital status and family income which are taken to reflect the child's socioeconomic circumstances at birth. Family income at first clinic visit was classified into two categories, namely, family earnings of $10,399 or less, and $10,400 or more. The figure of $10,399 in the period 1981–1983 represents a group who are estimated to be at or below the poverty level of income. Marital status at first clinic visit was also divided into two categories—those with a partner (mothers who were married or living in a de facto relationship) and those with no partner (mothers who were single, separated/divorced or widowed). Maternal age was coded into three categories: 13–19 years, 20–34 years and 35 years or more.

Cognitive development

Children's verbal comprehension scores were evaluated using the Peabody picture vocabulary test-revised (PPVT-R) (Dunn & Dunn, 1981). Children's motor skills were measured using the Denver developmental screening test (DDST) at 5 years. The PPVT-R tests a child's verbal comprehension and has been used extensively in previous research (Bracken & Murray, 1984; Naglieri & Pfeiffer, 1983). Dean's (1980) predictive validity estimates of the PPVT suggest moderate relationships with future achievement. The DDST measures developmental delay in fine motor, adaptive, gross motor, language and personal/social development. The DDST has been used successfully in many countries and has been restandardised for more than 15 countries (Struner, Green, & Funk, 1985).

At 14 years, assessments of cognitive development were based upon youth scores on Raven's standard progressive matrices (Raven's SPM) (de Lemos, 1989a) and the wide range achievement test (WRAT) (Wilkinson, 1993). It was decided to use these tests at 14 years because there were perceived as more appropriate indicators of a child's academic and employment future than were the tests used at 5 years of age.

The Raven's SPM is a test of non-verbal reasoning ability that has been widely used for psychological assessment in clinical and educational contexts, for research and for personnel selection (Raven, 1989; de Lemos, 1989a). Scores have been found to be increasing progressively with each successive generation (Raven, 1989). De Lemos (1989b) restandardised Raven's SPM scores, based on the mean and standard deviation at each year level. However, in this study, child scores have been standardised in six monthly groupings rather than yearly levels.

The WRAT is an age-normed referenced test that assesses reading and word decoding skills (Wilkinson, 1993). It has been found to be a stable measure (Dura, Myers, & Freathy, 1989) and to have high test-retest reliability (Woodward, Santa Barbara, & Roberts, 1975; Sundean & Salopek, 1971) and high internal consistency reliability coefficients (Mishra, 1981).

In analysing the data, child cognitive development scores have been categorised simply as those above the tenth percentile and those at or below the tenth percentile for the PPVT-R, WRAT and Raven's SPM.

Child mental health

Child mental health was assessed from maternal reports of child behaviour using the child behaviour checklist (CBCL) (Achenbach, 1991) at ages 5 and 14 years. Following Achenbach (1991), child behaviour problems and psychiatric morbidity were assessed using two subscales indicative of second order groupings of syndromes that he identified. These subscales include externalising behaviour (comprising delinquent and aggressive syndromes) and internalising behaviour (consisting of items measuring withdrawn behaviour, somatic complaints and symptoms of anxiety/depression). The forms used for maternal report were in their original form, save for a simplification in presentation. The response alternatives were 0 = "Often", 1 = "Sometimes" and 2 = "Rarely/never". Factor analyses and reliability estimates of subscales of the CBCL produced results consistent with Achenbach's (1991) data. A "case" was considered to be those children or youth scoring above the 90th percentile for the externalising and internalising subscales. Achenbach (1991) uses the 90th percentile for determining "caseness" in the total problems scale, but 2% and 5% cutoffs for borderline

and caseness determination, respectively, for the subscales.

At the 14-year follow-up youth were asked about their smoking behaviour. Responses were coded into smokers and non-smokers.

Data analysis

All scores for cognitive ability and mental health were dichotomised at the tenth percentile. These binary outcomes were analysed by logistic regression using SPSS, V.10. Unadjusted odds ratios were obtained from models which included only a simple co-variable of interest. All other co-variables were then added to give adjusted odds ratios and confidence intervals.

Results

Table 1 examines the loss to follow-up by the socioeconomic characteristics of respondents at the 14-year follow-up. As we have noted previously loss to follow-up is selective. The youngest mothers, those in the lowest income and those with no partner are most likely to be lost to follow-up. Losses at the 5 year and 14 year follow-ups are lower than those indicated in Table 1 (about 70% of sample giving birth responded at each of these phases).

Correlations of the continuous scores of the child cognitive and mental health scores were used to assess continuities over time. The Pearson correlations of child cognitive development at 5 (PPVT-R) and 14 years of age (WRAT, Ravens) are 0.29 and 0.36, respectively (all $p<0.01$). The correlation for child mental health (aggression at 5 years vs. aggression at 14 years is $r=0.48$, $p<0.01$) is moderately strong, with about twice as much variance in child mental health at 14 years of age being attributable to scores at 5 years of age, when compared with child cognitive development. Child behaviour (mental health) appears to be more stable over time than is child cognitive development, though there is a moderate to high level of continuity of all our indicators of children's health from childhood to adolescence.

Table 1
Percent lost to any phase follow-up

	N	Percent remaining in study	χ^2 *p*-value
Age of mother			
13–19	1271	45.4	
20–34	6041	62.6	
35+	349	58.2	
			$p<0.001$
Income FCV			
$10,399 or less	2466	54.0	
$10,400 plus	4583	70.4	
			$p<0.001$
Marital status FCV			
No partner	1028	40.1	
Partner	6472	64.1	
			$p<0.001$
Occupational status of grandparent			
Low	3469	66.2	
Mid-low	2484	67.7	
High to mid-high	833	69.9	
			$p=$NS

Cognitive development

Table 2 provides an analysis of the association between the mother's socioeconomic circumstances at entry to the study and the child's verbal comprehension at 5 years. After adjustment for the other SES variables, two effects remain statistically significant. Family income is a strong predictor of verbal comprehension (PPVT-R) scores at age 5, with the lowest income group of mothers reporting over twice the rate of children whose scores were at or below the 10th percentile. Children of grandfathers who were in the lowest status group were about twice as likely to score in the bottom 10% of PPVT-R scores, irrespective of the SES of the mother.

Family income is also a predictor of developmental delay at 5 years (Table 2). Mothers in the lowest income group were more likely to have children who scored poorly on the DDST. This effect remains significant after adjustment for the mother's age and marital status.

Table 3 provides a comparison of children who scored in the lowest decile of the Raven's progressive matrices (RPMs) by the mother's socioeconomic circumstances. Children whose grandfather was in either of the lowest two occupational status groups were about twice as likely to score in the lowest decile on the RPMs. This remained the case after adjustment for the age, family income and marital status of the mother. A second effect is that mothers in the lowest income group were more likely to have children who scored poorly on their RPMs at age 14.

Family income is also a predictor of scores on the WRAT (Table 3). Mothers in the lowest income group were more likely to have children who scored poorly on the WRAT. This effect remains significant after adjustment for the mother's age and marital status.

Child mental health

Table 4 examines the association between maternal SES and the mental health of the child. Data were derived from maternal reports on the CBCL. Teenage mothers are about twice as likely to have children who

Table 2
Cognitive development at age 5 by maternal socioeconomic status and occupational status of grandparent ($N = 3525$) (logistic regression, odds ratio compared to reference category)

	N	Verbal comprehension				Developmental delay			
		Unadj OR	95% CI	Adj[a] OR	95% CI	Unadj OR	95% CI	Adj[a] OR	95% CI
Age of mother									
13–19	432	2.28*	(1.29, 4.02)	1.74	(0.97, 3.12)	1.95	(0.42, 9.00)	1.57	(0.33, 7.42)
20–34	2926	1.21	(0.72, 2.05)	1.10	(0.65, 1.88)	1.87	(0.45, 7.70)	1.75	(0.42, 7.22)
35+	167	1		1		1		1	
Income FCV									
$10,399 or less	1040	2.40*	(1.96, 2.95)	2.27*	(1.83, 2.81)	1.71*	(1.08, 2.71)	1.70*	(1.05, 2.74)
$10,400 plus	2485	1		1		1		1	
Marital status FCV									
No partner	304	1.31	(0.94, 1.82)	0.77	(0.54, 1.11)	1.06	(0.48, 2.32)	0.85	(0.37, 1.99)
Partner	3221	1		1		1		1	
Occupational status grandparent									
Low	1819	2.16*	(1.45, 3.20)	2.08*	(1.40, 3.09)	1.64	(0.74, 3.63)	1.57	(0.71, 3.49)
Mid-low	1300	1.46	(0.97, 2.21)	1.50	(0.99, 2.27)	0.85	(0.35, 2.03)	0.84	(0.35, 2.01)
High and mid-high	406	1		1		1		1	

*Statistically significant $p < 0.05$.
[a]Adjusted for the other variables in the table.

Table 3
Cognitive development at age 14 (Raven's SPM and WRAT) by maternal socioeconomic status and occupational status of grandparent ($N = 4556$) (logistic regression, odds ratio compared to reference category)

	N	Non-verbal reasoning				Wide range achievement test			
		Unadj OR	95% CI	Adj[a] OR	95% CI	Unadj OR	95% CI	Adj[a] OR	95% CI
Age of mother									
13–19	401	1.08	(0.60, 1.94)	0.84	(0.46, 1.55)	1.96	(0.97, 3.99)	1.55	(0.75, 3.20)
20–34	2811	0.98	(0.58, 1.64)	0.94	(0.56, 1.57)	1.43	(0.74, 2.75)	1.40	(0.72, 2.69)
35+	158	1		1		1		1	
Income FCV									
$10,399 or less	944	1.40*	(1.11, 1.77)	1.34*	(1.05, 1.70)	1.83*	(1.43, 2.33)	1.73*	(1.34, 2.23)
$10,400 plus	2426	1		1		1		1	
Marital status FCV									
No partner	300	1.50*	(1.07, 2.11)	1.42	(0.98, 2.06)	1.42	(0.98, 2.06)	1.11	(0.74, 1.67)
Partner	3070	1		1		1		1	
Occupational status grandparent									
Low	11,741	2.22*	(1.42, 3.47)	2.19*	(1.40, 3.42)	1.43	(0.95, 2.13)	1.36	(0.91, 2.04)
Mid-low	1221	2.05*	(1.29, 3.23)	2.07*	(1.31, 3.27)	1.08	(0.71, 1.66)	1.09	(0.71, 1.66)
High and mid-high	408	1		1		1		1	

*Statistically significant $p < 0.05$.
[a]Adjusted for the other variables in the table.

manifest externalising and internalising behaviour problems, while those mothers who are in the lowest income group are somewhat more likely to have children who manifest these behaviours at 5 years of age. These associations remain after adjustment for the other variables.

Table 5 documents the association between maternal SES and externalising and internalising behaviour problems at 14 years of age. The data are derived from maternal reports of child behaviour using the CBCL. Teenage mothers, those from a low income family, those mothers without a partner and children with grandfathers in the lowest status group all have children with higher rates of externalising behaviour problems at 14 years of age. Once the associations are adjusted for other variables in the model then the main independent

Table 4
Mental health at age 5 (externalising and internalising— CBCL-modified) by maternal socioeconomic status and occupational status of grandparent ($N = 4601$) (logistic regression, odds ratio compared to reference category)

	N	Externalising				Internalising			
		Unadj OR	95% CI	Adj[a] OR	95% CI	Unadj OR	95% CI	Adj[a] OR	95% CI
Age of mother									
13–19	581	2.52*	(1.37, 4.62)	2.29*	(1.24, 4.25)	2.08*	(1.19, 3.63)	1.84*	(1.04, 3.25)
20–34	3816	1.58	(0.89, 2.80)	1.57	(0.88, 2.78)	1.45	(0.86, 2.45)	1.42	(0.84, 2.39)
35+	204	1		1		1		1	
Income FCV									
$10,399 or less	1375	1.40*	(1.14, 1.70)	1.29*	(1.04, 1.59)	1.44*	(1.19, 1.74)	1.37*	(1.12, 1.67)
$10,400 plus	3226	1		1		1		1	
Marital status FCV									
No partner	412	1.31	(0.96, 1.78)	1.00	(0.72, 1.40)	1.29	(0.96, 1.74)	1.04	(0.75, 1.43)
Partner	4189	1		1		1		1	
Occupational status grandparent									
Low	2328	1.14	(0.84, 1.55)	1.10	(0.81, 1.50)	1.27	(0.93, 1.73)	1.23	(0.90, 1.67)
Mid-low	1711	0.88	(0.64, 1.22)	0.88	(0.63, 1.21)	1.28	(0.93, 1.76)	1.28	(0.93, 1.76)
High and mid-high	562	1		1		1		1	

*Statistically significant $p < 0.05$.
[a]Adjusted for the other variables in the table.

Table 5
Mental health at age 14 (externalising and internalising— BCL) by maternal socioeconomic status and occupational status of grandparent ($N = 4560$) (logistic regression, odds ratio compared to reference category)

	N	Externalising				Internalising			
		Unadj OR	95% CI	Adj[a] OR	95% CI	Unadj OR	95% CI	Adj[a] OR	95% CI
Age of mother									
13–19	577	2.05*	(1.19, 3.53)	1.54	(0.88, 2.69)	1.30	(0.75, 2.26)	1.12	(0.64, 1.95)
20–34	3780	1.07	(0.64, 1.78)	1.05	(0.63, 1.76)	1.03	(0.63, 1.70)	1.02	(0.62, 1.68)
35+	203	1		1		1		1	
Income FCV									
$10,399 or less	1331	1.75*	(1.43, 2.14)	1.49*	(1.21, 1.85)	1.44*	(1.17, 1.78)	1.38*	(1.11, 1.71)
$10,400 plus	3229	1		1		1		1	
Marital status FCV									
No partner	412	2.19*	(1.66, 2.88)	1.62*	(1.19, 2.19)	1.38*	(1.01, 1.89)	1.18	(0.84, 1.65)
Partner	4148	1		1		1		1	
Occupational status grandparent									
Low	2297	1.78*	(1.25, 2.52)	1.74*	(1.23, 2.47)	1.44*	(1.03, 2.02)	1.42*	(1.01, 2.00)
Mid-low	1681	1.32	(0.92, 1.91)	1.36	(0.94, 1.96)	1.21	(0.85, 1.72)	1.22	(0.86, 1.74)
High and mid-high	582	1		1		1		1	

*Statistically significant $p < 0.05$.
[a]Adjusted for the other variables in the table.

predictors of externalising behaviour in 14-year-old children are the grandfather's occupational status and the mother's marital status and family income at first clinic visit. The relationship between internalising behaviour at age 14 by maternal SES is also documented in Table 5. Mothers in the lowest income group, those without a partner and those children whose grandfather was in the lowest SES group have higher rates of internalising behaviour problems at age 14. The income and grandfather occupational status effects remain statistically significant after adjustment for the other variables in the table.

In this study, self-reported smoking was recorded at age 14. Table 6 details the association between the child's smoking behaviour and the mother's socio-economic circumstances. There is a significant (unadjusted) association between the grandparents' occupational status, family income, maternal age and

Table 6
Child smoking at 14 years by maternal socioeconomic status and occupational status of grandparent ($N = 4543$) (logistic regression, odds ratio compared to reference category)

		Unadj OR	95% CI	Adj[a] OR	95% CI
Age of mother					
13–19	573	1.60	(0.94, 2.71)	1.34	(0.78, 2.29)
20–34	3769	1.22	(0.75, 1.98)	1.19	(0.73, 1.93)
35+	201	1		1	
Income FCV					
$10,399 or less	1324	1.37*	(1.13, 1.66)	1.27*	(1.04, 1.55)
$10,400 plus	3219	1		1	
Marital status FCV					
No partner	407	1.54*	(1.17, 2.04)	1.34	(0.99, 1.82)
Partner	4136	1		1	
Occupational status grandparent					
Low	2288	2.03*	(1.44, 2.86)	1.99*	(1.41, 2.81)
mid-low	1676	1.70*	(1.19, 2.43)	1.72*	(1.20, 2.45)
High and mid-high	579	1		1	

*Statistically significant $p<0.05$.
[a]Adjusted for the other variables in the table.

Table 7
Summary of significance tables for maternal socioeconomic status and occupational status of grandparent in prediction of mental health, cognitive development and smoking

	Child age 5				Child age 14					
	Cognitive development		Mental health		Cognitive development		Mental health			
	Verbal	Denver	External	Internal	Raven's	WRAT	External	Internal	C. Smoke	Total
Age										
Unadjusted	*	NS	*	*	NS	NS	*	NS	NS	4
Adjusted	NS	NS	*	*	NS	NS	NS	NS	NS	2
Income										
Unadjusted	*	*	*	*	*	*	*	*	*	9
Adjusted	*	*	*	*	*	*	*	*	*	9
Marital status										
Unadjusted	NS	NS	NS	NS	*	NS	*	*	*	4
Adjusted	NS	NS	NS	NS	NS	NS	*	NS	NS	1
Grandparent's occupation										
Unadjusted	*	NS	NS	NS	*	NS	*	*	*	5
Adjusted	*	NS	NS	NS	*	NS	*	*	*	5

maternal marital status at entry to the study and the child's cigarette consumption some 14 years later. After adjustment, the child's cigarette consumption is independently associated with the grandfathers' occupational status, mother's income and her marital status.

Table 7 provides a summary of the main associations observed in the previous tables. Family income during the pregnancy predicts child cognitive development and mental health at ages 5 and 14, as well as child smoking at 14 years of age. These associations are independent of all the other SES variables considered in the analyses. Grandfather occupational status is the other consistent socioeconomic association. Child cognitive development, mental health and child smoking are associated with the grandfather's occupational status, independent of the mother's family income. Curiously, these associations are most in evidence at the 14-year follow-up. Thus, while child mental health at 5 years of age appears to be unrelated to grandfather SES, these associations are observed some nine years later.

Discussion

In a society where the capacity to manipulate information and organise knowledge is increasingly

important, poorer cognitive development and consequent school performance have a range of long-term consequences. Opportunities for participation in more skilled occupations, higher incomes and a range of life opportunities are likely to be severely restricted for socioeconomically disadvantaged children. There is also a lesser capacity (or interest) in acquiring knowledge that may be relevant to a healthful lifestyle. The consistency of child IQ scores over time is arguably an indication of the biological contribution to child cognitive ability. Given the strength of the association between child mental health at 5 and 14 years of age, it could similarly be argued that child mental health is moderately stable over time and is likely to have a substantial biological component. Of course children retain not only their biological potential over time; most continue to live in environments which do not alter greatly. Thus the consistency of cognitive development and mental health over time reflects both biological and environmental influences.

In relation to cognitive development, children from low-income families were found to have higher rates of problems with language and reasoning ability. Socioeconomic inequalities in child cognitive development are consistently observed at 5 and 14 years of age. In addition to the impact of low family income on child cognitive development, the child's grandparents' occupational status independently predicted the child's verbal comprehension levels at age 5 and his/her nonverbal reasoning scores at age 14.

In regard to child mental health, several findings warrant comment. Low family income was found to make independent contributions to both externalising and internalising behaviours in children at 5 and 14 years of age. The quality of the home environment and access to resources may be at issue here. Teenage maternity appears to be associated with an increased risk of child mental health impairment at 5 years of age, but not (independently) at 14 years of age. Having a young mother appears to diminish in importance as the child grows up, but being reared in a low-income family remains important.

Single parenthood around the birth of the child has emerged as a factor, which increases the risk for externalising behaviour at 14 years of age. This raises the question of whether it is the absence of the father from the child's household in the early stages of the child's development that increases the risk for the development of aggressive behaviours in adolescence. Alternatively, while single mothers may be as well equipped to deal with young children as partnered mothers, for those who remain single, adolescence may present particular problems that are difficult to manage without support from another adult. For mothers who marry in the child's early years or later, or those who have one or more partners during the child's early development, their offspring will necessarily be exposed to changes within the household that have the potential to impact negatively (as well as positively) on the child. All of these possibilities warrant further investigation. The higher rates of smoking of children of low income, single and young mothers, suggest that socioeconomically disadvantaged children are at greater risk for acquiring behaviour which is damaging to their health.

The results point to the transgenerational, socioeconomically related acquisition of cognitive development, mental health impairment and health-related behaviours in children. The Barker (1991) hypothesis could be taken to suggest that family environmental circumstances (including maternal nutrition) may have taken long-term health consequences for the foetus. Grandparents categorised as low SES may provide a less advantageous reproductive environment for their children.

Harper et al. (2002) have also found that parents' socioeconomic circumstances impacts on mental health independently of a respondent's current economic circumstances though their study differs substantially from the approach adopted in the current study. It is of particular interest to note the association between the SES of the grandfather of the child and the child's cognitive and emotional development, and smoking behaviour at 14 years of age. This effect is independent of the mother's own SES. One can speculate about a number of mechanisms which could account for these associations. As Ben-Shlomo and Kuh (2002) point out, grandparents, parents and children share genetic and environmental influences. For example, both breastfeeding (Quinn et al., 2001) and maternal tobacco use (Williams et al., 1998) may be associated with child cognitive development and emotional health. Both breastfeeding and maternal tobacco use may be determined by familial influences (grandparent effect?), yet act in a manner which has biological consequences for the child. We are not able to determine the causal sequence involved, yet the data indicates that some health inequalities are transmitted across generations, in addition to the effects associated with the child's current SES. Another possibility is that mothers will have acquired a range of health-related behaviours from their parents (e.g. diet, smoking, activity level) that are not adequately reflected in indicators of their own SES. Why these effects are not observed using indicators of the mother's SES is a matter of theoretical and substantive interest.

Our research design has imposed certain limitations. As SES variables were measured at entry to the study and prior to the birth of the child, we do not consider changes to the child's circumstances in the years subsequent to the mother's first clinic visit. Single mothers may have married or entered de facto relationships, and low-income mothers may have experienced

increases in income. Had SES been measured concurrently with child outcomes at 5 and 14 years, different results may have emerged. Our findings do not take into account the effects of cumulative disadvantage after birth.

Selective attrition may also have influenced the magnitude of associations we have observed. Children in the most economically disadvantaged groups are disproportionally lost to follow-up. This suggests that the associations we have observed are likely to be conservative; adding more lower SES respondents who have poor cognitive outcomes and mental health would increase the magnitude of the associations we have observed.

Conclusion

Overall the results are clear and persuasive. At ages 5 and 14, children born to mothers in the lowest SES group have a much greater likelihood of manifesting cognitive development problems, and their language comprehension is well below that of their more economically advantaged counterparts. Their mental/emotional health is more likely to be impaired, and they are more likely to be early adopters of high-risk behaviours such as cigarette smoking. In this sense, the script for these children's lives has been substantially written by the time they reach the age of 14.

In each domain under study, children living in poverty are demonstrably at greatest risk for outcomes which may compromise their short- and long-term health, well-being and achievements. Family of origin, single parenthood and teenage motherhood are factors which contribute to the health of youth, in addition to the associations observed for family income.

The combination of findings from this study over several domains during childhood and adolescence highlights the significance of the child's early years as a period when a platform for subsequent health is laid down. The pathway to adult health inequalities includes biological and socially acquired inequalities in physical development, emotional state and early health-related lifestyles. Low family income and the SES of the family of origin of the mother of the child are the main independent predictors of the child's mental health and cognitive development. Health interventions likely to be effective will need to take a broad view of the causes of SES health inequalities. Socioeconomic disadvantage in its various forms in the foetal and early childhood period creates a group of children who have a reduced capacity to benefit from the health and economic advances experienced by the rest of the population. When these children become adults they will similarly be more likely to transmit their inherited and learnt health disadvantages to their own children. It follows that interventions to redress these health inequalities must begin early in life, must be extensive in their impact and be implemented over a significant period of the life course.

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